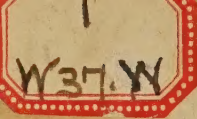


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THE WEATHER BUREAU

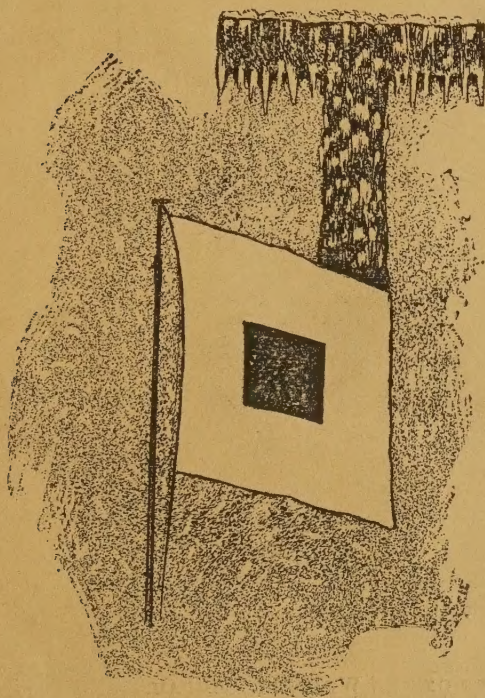
OF THE

UNITED STATES DEPARTMENT OF
AGRICULTURE.

ITS ORGANIZATION, HISTORY, AND VAST IMPORTANCE TO ALL FARMERS.

BY MORTIMER WHITEHEAD.

From THE AMERICAN FARMER (1729 New York Ave., Washington, D. C.,) issue of April 1, 1892.



HE weather, our friend and our foe, without which we could not live, and with which we sometimes almost die. Here's to the weather.

How much it has to do with our lives, our health, our comfort, our happiness, our successes and our failures.

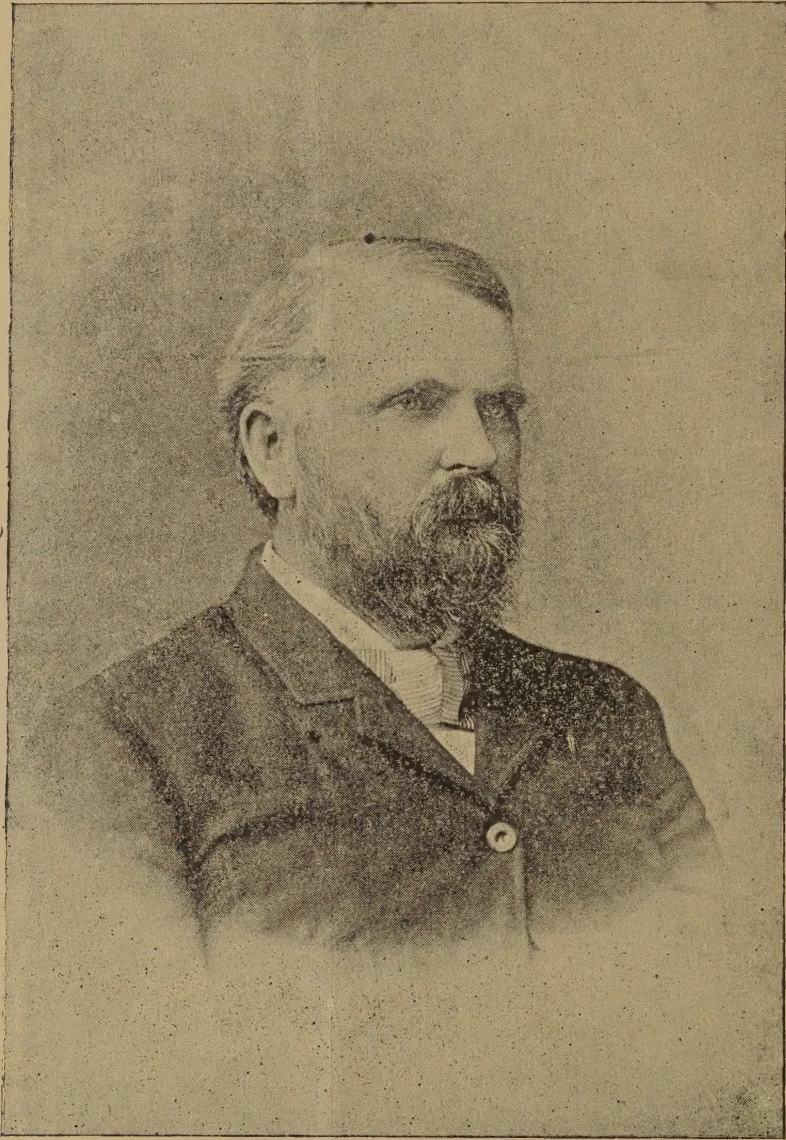
Those engaged in all trades, professions and callings, the dweller in country, in city, and they "who go down to the sea in ships" have this much in common, and are here "equal before the law" that controls the sunshine or the storm.

Upon "what will the weather be tomorrow" has depended since the world began the fate of individuals, of campaigns, of nations. Had the little fleet of Columbus been destroyed by one of the storms that sometimes sweep the seas o'er which he sailed, the new world would perhaps be a century younger, and the Chicago Exposition would be yet a hundred years in the future.

While most talked about, the weather is not always considered a good topic for conversation, and in some social circles it is prohibited even to the extent of fining anyone who shall introduce it. But it is not always a dry subject, and like the poor it is always with us.

Almost as old as the weather itself is its folk-lore; handed down from the dim past are the "signs" that still control the actions of many, and he who is "weather-wise" in some communities is looked up to as a prophet not without honor even in his own country. The planets, the days of the saints, the ground hog, the goosebone, the hight of the hornet's nest, the thickness of the cornhusk or of the squirrel's fur,

the way the sheep looks when it gets up, do the swallows fly high or low; the flight of wild geese, the position in the sky of the new moon, and the old style almanacs



PROF. MARK W. HARRINGTON, CHIEF OF THE WEATHER BUREAU.

are still consulted in many neighborhoods where weather rhymes were once learned as carefully as Bible texts.

"When fleas do very numerous grow,
Then 'twill surely rain or snow."

"Evening red and morning gray
Will put the traveler on his way;
But evening gray and morning red
Will bring down rain upon his head."

"A fly on the nose, we slap and it goes,
If it comes back again it will bring a good rain."

Or if—

"The soot falls down, the squirrels sleep,
The spiders from their cobwebs creep.
Loud quack the ducks, the peacocks cry,
The distant hills are looking nigh.
How restless are the snorting swine,
The busy flies disturb the kine.
Hark! how the chairs and tables crack,
Grandmother's joints are on the rack.
Puss on the hearth with velvet paws,
Sits wiping off her whiskered jaws.
My dog so altered in his taste,
Quits mutton bones on grass to feast.
'Twill surely rain. I see with sorrow
Our work must be put off to-morrow."

Surely they are the "old" probabilities now, and yet they were not all absurd; for animals, like people, are affected by climate and their feelings like ours are sometimes "predictions" that can be relied upon, and "under the weather," while old as an expression, is a true sanitary term. It follows, then, that even among all the chaff of old-time weather forecasts there are a few grains of wheat.

But all who talked and wrote and prophesied about the weather in the olden times were not believers in "signs" and were not dealers in superstition, depending for fame upon the credulity and ignorance of the people. Even in the dark ages there were some faithful, earnest students seeking light, knocking at the doors of Nature's great temple asking for the *truth* with which to combat the sham. Konrad, of Megenberg, in the "Book of Nature," the oldest natural history in the German language, written about the year 1350, first printed in Augsburg in 1475, and which within 50 years reached seven editions, wrote some things which may yet be read with profit by some in these days of artificial rain-making. Speaking of rain Konrad says:

Rain comes from the watery vapour which the sun's heat has raised up into the middle region of the atmosphere, when, owing to the cold which is there, the vapour is again converted into water, as we see in the vapour which arises from the boiling kettle over the fire; when the vapour touches the cold iron lid of the kettle it is converted into drops of water.

But—

"New occasions teach new duties,
Time makes ancient goods uncouth,"

and with the passing of the ground hog, the goosebone, and the old-time almanac comes the *new* "probabilities," the exact science, the reasoning from cause to effect, that makes the weather service of to-day of world-wide importance; lives and property to the extent of millions in ventures on land and sea depending upon the accuracy of the "predictions."

Now as ever the weather is a subject of general importance, and all civilized countries are pushing out and perfecting their work in this direction. Russia has 334 stations of observation; at 51 stations the temperature of the soil is taken at the surface and at some 10 different depths. At 44 stations observations are made as to the evaporation of water. Even in China and Japan daily observations and records are made.

At Munich, Bavaria, from Aug. 26 to Sept. 2, 1891, was held an International Meteorological Conference, composed of the heads of the meteorological services of 17 different Governments, representing Europe, Asia, Australia, North and South America. Yes; all the world is interested in the weather, and in this, as in other things,

"One touch of nature,
Makes the whole world kin."

Before adjourning those attending this International Conference at Munich agreed to attend the general congress of meteorologists from all parts of the world to be held at Chicago in 1893, and that another International Congress should be held in Paris in 1896.

As an incident of this conference, pointing out the lines upon which the science of meteorology is now being most extended, Prof. Wild, the representative of the

weather service of Russia, and Prof. Mark W. Harrington, Chief of the Weather Bureau of the United States Department of Agriculture, united in presenting a resolution which was adopted and of which the following is a part: "That it should be impressed upon the committee, which may be appointed, to consider the subject of the proper method of extending meteorological observation and publication in the interest of agriculture, and that this committee prepare a proposition thereon for the future general congress." In accordance therewith the subject of agricultural meteorology was made one of the leading matters for investigation and future consideration by the conference; and thus did the worthy representatives of these two great nations, whose most important industry is agriculture, unite to advance the calling that feeds the world.

While the science of meteorology is not new, it is only in recent years that it has been made of general practical use, brought down out of the clouds, as it were, and applied to the affairs of every-day life. It is now popular because it has been popularized. The harvest of its years of observation, record, and study is now being dispensed for the benefit of the humblest citizen. Away back in the early years of our Republic the Surgeons of the Regular Army at the various posts were required to keep a record of temperature, storms, etc., but it was not until after our last war that the Signal Service, which had proven of such efficient use in connection with army movements, was broadened and somewhat extended. In 1871 Gen. Hazen began the agitation of a plan for a more general distribution of information in regard to weather prospects, based on meteorological observations to be made by the officers of the Signal Service. It attracted but little attention at first, and had slight help from the Government, but substantial support came in time. Gen. Hazen was succeeded by Gen. A. W. Greely, who still more developed and proved its usefulness.

In 1890, urged by farmers in their organizations, and by Secretary Rusk, of the Department of Agriculture, himself a practical farmer, the law was passed by Congress transferring the weather service from the War Department to the Department of Agriculture. The signal corps for war purposes still exists in the Regular Army, but all the paraphernalia of the work pertaining to weather observations, display of forecast signals, etc., together with nearly all the officers and assistants, were turned over to the control of the Secretary of Agriculture on the first day of July, 1891, and while but nine months have passed since that time, the Bureau has been entirely reorganized and its efficiency greatly extended. As contemplated by the act of Congress making the transfer, while the advantages of the old service, which had been mainly used for commerce, were not in any way curtailed, the great improvements and extension of the work of the Bureau have been upon the lines of agriculture.

The implements of war having been turned over to the fields of peace—fields that cover all our great National domain—a head to direct and a hand to guide must be sought out, well trained, and adapted to so important a mission. These were found in the person of Prof. Mark W. Harrington, of whom a writer in the *Boston Transcript* of last July said:

As a colleague of Prof. Harrington, the newly-appointed Chief of the United States Weather Bureau in Washington, which to-day is transferred from the Army to the Agricultural Department, I send you the following biographical sketch, which will no doubt be of interest to many of your readers.

The subject of this notice is descended from the earliest settlers of New England. His great-grandfather and several others of the family of that generation took part in the Revolution, and the celebrated Judge, Theophilus Harrington, was a member of this family. Through his mother, he is descended from the Dutch Walradt family, of New York. Mark Walrod Harrington was born in 1848, on a farm near Sycamore, Ill. He prepared for college at Evanston, and graduated from the University of Michigan in 1868, when he entered the department of biological science in that institution as an instructor. In 1870 he went to Alaska as Acting Astronomical Aid to the United States Coast Survey, in the earliest reconnaissance conducted by Mr. W. H. Dall. He returned to the University of Michigan in 1872, and, in 1876, went to Leipsic to study in that university. At the end of a few months Mr.

Harrington was appointed Professor of Astronomy and Mathematics in the School of the Chinese Foreign Office at Peking, which position he held but one year, as his health failed in that climate, and he was obliged to return to America. In 1879 he was made Professor of Astronomy and Director of the Observatory at Ann Arbor, Mich., where he succeeded Prof. Watson, and this position he has held until the present time.

In 1884 he founded the *American Meteorological Journal*, a scientific monthly, which has always been published at a financial sacrifice to the editors, but has nevertheless reached its seventh volume, and is the only magazine devoted to meteorology in this country. In 1886 the writer became associate editor of the *Journal*, and three years later Dr. W. J. Herdman, of Ann Arbor, joined the editorial staff.

Prof. Harrington has traveled extensively, is a prolific writer, and is well versed in botanical, meteorological, astronomical, and mathematical literature. He is a life member of the Linnean Society of London, and a Fellow of the Royal Meteorological Society. That he is admirably suited for the position of Chief of the Weather Bureau is recognized by all who know him, and the writer ventures to predict that under his direction, aided by the civil character of the Bureau, which will now render enlistment in it attractive to scientific men throughout the country, the weather service of the United States will expand in directions in which it has hitherto been cramped by its military regulations, and that it will come to hold the first place among the meteorological services of the world.

With two such leaders as Secretary Rusk and Prof. Harrington, whose birth and early training on the farm has always kept them in such close touch with the tillers of the soil, what wonder is it that the number of stations for observation were increased over 150 per cent. within the first four months of the new regime, and that at present at nearly 3,000 stations regular observations are made, while a demand for a greater number from all parts of the country was never so great as now, and the extension is retarded only by the limited appropriation for the service.

As a key to the lines upon which the Weather Bureau is now being conducted, a few extracts are given here from an article entitled "How Could the Weather Service Best Promote Agriculture," written by Prof. Harrington before he became its chief, and published in the *American Meteorological Journal* for May, 1891. Upon the general subject of the (then) coming transfer and its work for agriculture he says:

This will add greatly to the usefulness of the service, but it will also add to the volume of its work and to the difficulties it will have to overcome.

Of the absolute necessity for more stations, so as to arrange for forecasts of local storms, so important for farmers to know, he says:

This requires that the printed forecasts should be placed in his (the farmer's) hands as soon as possible after they are made out—a matter of great difficulty, especially in a sparsely-settled country. Prof. Nipher has pointed out the possibilities of the telephone in this direction. Its rapid extension may be confidently expected as soon as the patents expire and it passes into the free ownership of the public. Another way to meet the difficulty is to be found in the extension of the delivery of mail over country districts, as has long been the case in England. The establishment of numerous centers for district forecasts would accelerate the distribution of forecasts. If the forecasts could be printed promptly in the County papers, mail delivery in the country would promptly place them in the hands of the farmers.

* * * The predictions of frosts, floods, and cold and hot waves have already been made, and to these should be added others not less important in some parts of our territory. Among them are the hot winds of the Plains, those of the Sacramento and San Joaquin Valley, the northers of Texas, and the chinooks east of the Rocky Mountains. *Climatic features*—To the farmer the problems of the climate have a permanent, while those of the weather predictions have only a passing, interest. * * * It is the average weather or climate which determines the agricultural capacity of a region. An unfavorable climate is quite as vigorously exclusive as an unproductive soil.

Prof. Harrington then shows that but little has been done in this important direction, but tells of some few instances as illustrations;

* * * The warm band existing half way up the Alleghanies * * * a cold island in southeastern Michigan * * * hot winds of the Plains * * * distribution of average wind velocity over the States * * * the sea breezes of the Massachusetts coast * * * our cold waves. These are all of high importance to the farmer, but the number of them is so few that they hardly do more than serve as specimens of what can and ought to be done for him. * * * The distribution of snow in the States is imperfectly understood, though it possesses features of unusual interest and importance. * * * Precise information on these subjects, placed in the hands of our agricultural class, would add greatly to the ease and

certainty of farming. * * * All the information relating to each climatic division of the States should be summed up in a special climatology of that region, and this should be printed under such conditions that the intelligent farmer could learn of its existence and could acquire it. * * * The books should tell the facts in such a way as to warn as well as to encourage. No rose-colored account of the climate is needed, nor is the climate to be painted in colors untruthfully dark. Such climatologies will be issued only too often by those who have personal interests to serve. * * * *Special Agricultural Meteorology*—Under this head come the relations between plants, soil, and meteorology. * * * Among the problems which must be studied are the action of soil and surface covering on the meteorological elements and the corresponding reactions; the effects of exposure, inclination, color, and constitution of the soil; the ground-water and its variations and motions, and the air in the soil and its changes. Under this head would also be included forest meteorology. * * * Observations of temperature and precipitation above trees are yet very much needed. * * * The relations of the weather to the different stages of plant growth. * * * The distribution of a species of plants is largely due to the climate. Plants cannot move, and their existence on a spot is a key to the climate. * * * Popular education in meteorology should be encouraged. * * * All agricultural colleges should give elaborate courses in meteorology; it is to be feared that some give none at all in this important branch. It should be taught in the universities and colleges—at least as an elective study—and here its scientific and mathematical foundations should be given rigorously. Elementary and simple meteorology should be given in the public schools. * * * A series of popular publications and public lectures on the subject of meteorology would also do much service in this direction.

Upon these general lines then the Weather Bureau is now being broadened and developed, new work is being taken up, new stations of observation are being established, while those for the display of the forecasts are now numbered by the thousands. Railroads, telegraph and telephone lines, postoffices, owners of mills and factories, using their steam-whistles, and newspapers, with their millions of daily readers, all co-operate to extend the constantly-improving results obtained by the Bureau as quickly, and as far and as wide as possible.

Among the most important and valuable portions of the legacy that the new Weather Bureau received from the War Department when the transfer was made, was the corps of scientific and well-trained specialists in the science of meteorology; some young, others grown gray in the service, but all enthusiastic in their work, and possessing an *esprit de corps* that adds greatly to the present success and future prospects of the Bureau. Some of these have been sent out to distant State central stations to organize and arrange the details of new work, and are controlling more local stations in single States than were at one time connected with the entire service. Nearly all the States now have a State weather service, which co-operates with the National Bureau in the work of observation and preparation of forecasts, display of signals, the publication of maps, weather-crop reports, the condition of rivers, and a number of them issue monthly general reports full of valuable data.

The outline of a part of the routine work of the Bureau may be of interest. The ancients based their forecasts upon the appearance of the sky, the movements of animals, and other natural phenomena, that through long years of observation led up to some accuracy; but their lack of knowledge of physical laws prevented any rapid progress or improvement. The invention of the thermometer and the barometer were the first reliable means for observing and recording meteorological conditions, and these are of great value to the individual who desires to make forecasts for his own locality. But when Franklin tamed the lightning and Morse harnessed it for its use in outriding the wind and storm, they made possible the forecasts covering a continent by collecting the weather conditions over all portions of that continent *at the same instant*, and placing them a few minutes later at one central point, and thus a new method has come into use combining on a chart the several elements of the weather observed at the same moment at a large number of stations and covering as great an extent of territory as practicable.

These maps are styled synoptic charts, from a Greek word meaning "a general review;" that is, over a large tract of country. Twice every day, at 8 a. m. and 8 p. m., 75° meridian time, if we could take a bird's-eye view of our great country, we would see the hundreds of observers climbing the steps to their instruments, placed upon an elevated place and building, so as to be free and unobstructed by

neighboring objects, and taking the data which is at once telegraphed to the central office at Washington. The observers report the air pressure reduced to sea level, temperature, dew point, wind direction and velocity, amount, character and direction of clouds, character of weather, whether cloudless, partly cloudy, cloudy, raining, sleeting or snowing, and the amount of rain or snow. In addition to the reports sent to the central office from all parts of the United States, others are received from Canada, Bermuda, and Cuba. These telegraphic reports are sent in cipher, not on account of secrecy but to save expense, as a single word will often represent a sentence. From all the data thus received twice each day are the forecasts made, and the maps showing the conditions prevailing at one time in all parts of the country are prepared, printed, and sent out by thousands, and all within an hour or so after the time that all the observations were made. At one time these maps were prepared only in Washington, but they are now made and printed at some 65 stations, and upward of 7,000 copies are issued daily; in addition to which they are printed in reduced size in the large morning and evening papers of several cities to the aggregate number of more than half a million of copies. At one time the forecasts were also made only in Washington, but there are now 20 local forecast officials at leading centers who also issue forecasts in connection with those received from the central office. Another important forward step which has made the service far more practical in thousands of localities, has been the longer time ahead for which the forecasts are made. Instead of predicting for the coming 24 hours as under the old rule, since Jan. 1 of this year they are made for a period of 36 hours ahead, so that even in remote sections of the country persons interested can know the night before of the probabilities for the next day. These maps are gaining in popularity all the time, and thousands of business men, farmers and others are becoming quite expert by their study in forecasting the weather for themselves, and thus, as time goes on, every man can indeed become his own weather prophet. In some places students of these Government weather maps have obtained not a little notoriety as weather prophets, the source of their "weather-wise" predictions being as yet not generally known by their neighbors.

The preparation and publication of the daily weather maps is only a small part of the work of the central office of this city. The many and delicate instruments used in all the large number of stations are here adjusted, repaired and sent out, as are also the signal flags and other material from the storerooms. One of the best-fitted telegraph stations keeps up its merry rhyme of words day and night, back and forth with the stations of our country and many of those in foreign lands. A complete printing department, with its composing-room, press-room, folding and stitching-room, turns out the printed page by millions in a year; not the least of which is a large edition, sent to schools, colleges, libraries, and individuals, of the *Monthly Weather Review*, a magazine containing a complete history of the weather at all points for a month and all meteorological data pertaining to the service. This *Review* is published by authority of the Secretary of Agriculture, under the direction of Prof. Harrington, by a board of five editors representing important divisions of the Bureau. A library of over 12,000 volumes, not counting pamphlets, maps, etc., daily growing in size and value, contains much of the meteorological, physical, and geographical lore of the world. Scientists noted as specialists are constantly making studies of figures and phenomena in their various lines. The elaborate files, a portion of which are kept in large fireproof vaults, and well-filled shelves of the Records Division, as its name implies, has charge of all the facts, figures, and other data obtained throughout the world by long years of observation and study; while the Executive and State Weather Service Divisions have as a part of their duties the supervision, conduct, and extension of all the thousands of stations for observation and display. The organization and system seems to be almost perfect and moves on smoothly and efficiently, unaffected by the wind or weather with which it deals; the tone and spirit of all seems to be to perfect the service and to extend it to a still greater field of usefulness.

As outlined by Prof. Harrington in the article before quoted, one of the means he proposed for extending the benefits of the Weather Bureau was to have meteorology taught in the schools. Already much progress has been made in this direction. In October of last year E. B. Dunn, local forecast official for New York City, co-operating with the Board of Education and Superintendent of schools, commenced furnishing each morning to 15 grammar schools, the Normal college, and the College of the city of New York copies of the weather maps. One hundred and fifty teachers were first instructed, and they are thus able to interest the children, who will not only be able to forecast the weather, but the use of the maps aid in the study of physical and general geography. Boston was even ahead of New York in distributing the maps to schools and colleges, and they now go out all over Massachusetts and other New England States for the use of schools. Other States are moving on the same line; out in Wisconsin they are used in all the normal and in most of the high schools.

The Weather Bureau is rendering important service to farmers and others by the publication of its weather-crop bulletins, issued as they are, weekly, during the crop planting, growing, and harvesting seasons, from early Spring to late in the Autumn. They are based upon the reports of local volunteer observers located in many different neighborhoods in each State, already averaging nearly one for each County. The prospective yield of crops depends largely upon the weather—too much or too little rainfall, too cold or too warm, early or late frosts. The yield largely fixes the value, and if the farmer can know crop conditions all over his own and other States from week to week, he knows the value of his crop, and is not at the mercy of speculators and others who have heretofore taken pains to keep themselves well posted, while the farmer in the dark sold below real value. These weekly weather-crop reports and bulletins are universally popular where they are known and studied, and many illustrations could be given of their practical value to the farmer. A grape-grower in New Jersey not long since wrote of his experience. A buyer made him an offer for his crop. The grower wanted more, but the speculator told him how heavily the Concord vineyards were yielding that year. This was on Saturday, and as they could not agree upon terms the grower told the man to come back Monday, when he would have his weekly weather-crop report. The buyer said that was all right. He returned on Monday, and the grape-grower was smiling. The crop report showed that the vineyards elsewhere had commenced rotting badly. He told the speculator that he wanted \$100 more for his grapes and he got it. Yes, there are millions in it for intelligent, progressive farmers, who are learning that it is just as much a part of their business to sell a crop and to know all about supply and demands as it is to grow the crop.

Another item of progress is the arrangements made for the display of frost warnings in localities growing crops liable to injury, which might be protected or gathered if the coming freeze was known in advance. The Directors at the central station in several States were last year instructed to perfect frost-warning systems to cover tobacco, truck, cranberry, and other fruit, and perishable crop-growing sections requiring such warnings; the result of such a system in Wisconsin alone having been so thoroughly satisfactory that the warning of a killing frost in four of the west central Counties on the 24th of August resulted in the saving of one-third of the cranberry crop (amounting to over \$125,000) through flooding, whereas the remainder of the crop was destroyed, owing to no facilities for protecting it from the predicted frost. In Minnesota and the Dakotas, frost warnings were issued during August of the same year to protect the grain, and little or no damage resulted where farmers used smudges to cover their fields with a dense smoke during the period of anticipated frost. In the State of Kentucky alone nearly 150 frost-warning stations have been established and are now in operation. Only this last month (March 11) a Memphis (Tenn.) paper contained the following item in a telegraphic dispatch, telling of the sudden cold wave in Mississippi: "No damage resulted to tomato plants, as growers were warned by cannon firing on receipt of

Weather Bureau report. Prospects are still good for over 2,000 acres in at this place."

California now produces millions of boxes of raisins annually; they are dried in the sun, spread out on trays, and are spoiled by rain. A dispatch from San Diego, Cal., Sept. 27, 1891, told of a heavy rain, and said: "The raisin-growers had been suspicious of rain, and some were advised by the Weather Bureau, so trays full of raisins were speedily stacked or covered, and but little damage was reported on account of the wet." Another California newspaper item, from another district, reads: "The Weather Bureau had given ample warning, and all the available help that could be secured was set at work stacking and covering the raisins in the vineyard." This year observations will be made and data collected on thunder storms, upon the amounts of which depends millions of dollars in value in the hay and grain harvest season alone.

Pages more could be used in telling of what has been already accomplished, what is now being done, and how much more can be done as the means are provided for the extension of the service. A large portion of the work has hardly been mentioned—its river, lake and ocean stations, so important to tell of coming floods and storms, and the great saving in life and property through these branches of the service. Then there is the vast amount of facts and figures that are being collected and put to practical use in a hundred different ways; aiding physicians in their studies of diseases, and the effects of different climates upon individuals afflicted with various ills. The records that are used by courts as evidence; by engineers and others. The merchant telephones the local station to know of the coming weather, that he may hold or ship his perishable produce. Even Barnum's "biggest show on earth," that was to have made its annual parade of several miles through the streets of New York, a few days ago, consulted the Government observer the day before, and on the forecast given the advertised parade was postponed, although at the time of the inquiry the sky was clear.

The Bible record of the olden time says: "The wind bloweth where it listeth and we hear the sound thereof, but no man knoweth whence it cometh or whither it goeth." It is true that we do not know all about the wind, but of late we do know much of its ways, its comings and its goings, as we do of other matters connected with the weather; and the end is not yet. From thousands of flagstaffs every day fly forecast signals, now generally so well understood, and the carefully-kept records show that it predicts aright 85 to 90 times out of 100, and as the observation station are extended they are becoming more perfect all the time. Railroad trains carry the signals on the sides of their baggage cars, and so post the people of all the country 'round who are in sight as they fly along the rail. Thousands of steam whistles—and their numbers are daily increasing—on mills and factories toot the combinations of long and short blasts that tell for miles away of coming changes, and proclaim as well the practical benefits and success of this part of the work of him who looks after all of Uncle Sam's farms and of the wise direction of his able lieutenant.

As before said, the possibilities of the Weather Bureau for good, not only to agriculture but to all the varied interests of our country, are limited only by the appropriations that may be made by Congress to extend its usefulness. Only \$75,000 additional has been asked for this year to extend the telegraph service of conveying to the people in city and country (especially to the farmer) the information now so well collected and arranged for practical use. This amount, asked for the whole United States, would doubtless be saved in a single County by timely warnings of coming storms or frosts. The amount now appropriated that may be charged to agriculture and internal commerce is only about \$100 for each County of the United States, or six cents for each farm, and less than one-half a cent for each of our population for a whole year. Its warning signals for sea and land in a single day have saved property worth more than all the cost for a year.

THE FLAG AND WHISTLE SIGNALS

Adopted by the United States Weather Bureau.

1. The Weather Bureau furnishes, when practicable, for the benefit of the general public and those interests dependent to a greater or less extent upon weather conditions, the "Forecasts" which are prepared at this office daily, at 10 a. m. and 10 p. m., for the following day. These weather forecasts are telegraphed to observers at stations of the Weather Bureau, railway officials, and many others, and are so worded as to be readily communicated to the public by means of flags or steam whistles. The flags adopted for this purpose are five in number, and of the form and dimensions indicated below:

EXPLANATION OF FLAG SIGNALS.



Number 1, white flag, six feet square, indicates clear or fair weather. Number 2, blue flag, six feet square, indicates rain or snow. Number 3, white and blue flag (parallel bars of white and blue), six feet square, indicates that local rains or showers will occur, and that the rainfall will not be general. Number 4, black triangular flag, four feet at the base and six feet in length, always refers to temperature; when placed above Numbers 1, 2, or 3 it indicates warmer weather; when placed below Numbers 1, 2, or 3 it indicates colder weather; when not displayed, the indications are that the temperature will remain stationary, or that the change in temperature will not vary more than four degrees from the temperature of the same hour of the preceding day from March to October, inclusive, and not more than six degrees for the remaining months of the year. Number 5, white flag, six feet square, with black square in centre, indicates the approach of a *sudden* and *decided* fall in temperature. This signal is not to be displayed unless it is expected that the temperature will fall to forty-two degrees, or lower, and is usually ordered at least twenty-four hours in advance of the cold wave. When Number 5 is displayed, Number 4 is always omitted.

2. When displayed on poles the signals should be arranged to read downward; when displayed from horizontal supports a small streamer should be attached to indicate the point from which the signals are to be read.

INTERPRETATION OF DISPLAYS.

- No. 1, alone, indicates fair weather, stationary temperature.
- No. 2, alone, indicates rain or snow, stationary temperature.
- No. 3, alone, indicates local rain, stationary temperature.
- No. 1, with No. 4 above it, indicates fair weather, warmer.
- No. 1, with No. 4 below it, indicates fair weather, colder.
- No. 2, with No. 4 above it, indicates warmer weather, rain or snow.
- No. 2, with No. 4 below it, indicates colder weather, rain or snow.
- No. 3, with No. 4 above it, indicates warmer weather, with local rains.
- No. 3, with No. 4 below it, indicates colder weather, with local rains.
- No. 1, with No. 5 above it, indicates fair weather, cold wave.
- No. 2, with No. 5 above it, indicates wet weather, cold wave.

EXPLANATION OF WHISTLE SIGNALS.

3. NOTE.—The warning signal, to attract attention, will be a long blast of from 15 to 20 seconds' duration. After this warning signal has been sounded, long blasts (of from four to

six seconds' duration) refer to weather, and short blasts (of from one to three seconds' duration) refer to temperature; those for weather to be sounded first.

Blasts.	Indicate.
One long	Fair weather.
Two long	Rain or snow.
Three long	Local rains.
One short	Lower temperature.
Two short	Higher temperature.
Three short	Cold wave.

INTERPRETATION OF COMBINATION BLASTS.

One long, alone	Fair weather, stationary temperature.
Two long, alone	Rain or snow, stationary temperature.
One long and one short	Fair weather, lower temperature.
Two long and two short	Rain or snow, higher temperature.
One long and three short	Fair weather, cold wave.
Three long and two short	Local rains, higher temperature.

(By repeating each combination a few times, with an interval of ten seconds between, possibilities of error in reading the forecasts will be avoided, such as may arise from variable winds, or failure to hear the warning signal.)

The Lecturer.

Patrons of Husbandry, Lecturer's Department
National Grange, Washington, D. C.

FARMERS AND THE WEATHER.

To those of us who have been working for years to have agriculture, the great underlying industry of our country, fostered, protected, and advanced somewhat in proportion with other civilized nations, and who have rejoiced that a small bureau has grown into a great Department of the Government, with its head, the Secretary of Agriculture, with a seat at the council table of the President—it is, indeed, pleasant to note and record the advance steps being taken under the guidance of one who, himself a practical farmer, and always identified with husbandry, knows how to improve the broadened field, and to make practical application of the new ways and means provided.

In 1890, urged and sustained by the Grange organization and by Secretary Rusk, the law was passed by Congress transferring the Weather Service from the War Department to the Department of Agriculture.

As contemplated by the act of Congress making the transfer, while the advantages of the old service, which had been mainly used for commerce, were not in any way curtailed, the great improvements and extension of the work of the Bureau, since then, have been upon the lines of agriculture.

In an official circular sent out last year by the Lecturer of the National Grange a few days after the transfer was made, the following prophecy was made:

The Good Book tells of those who “beat their swords into plowshares and their spears into pruning hooks.” On July 1, of this year 1891, the Weather Bureau, that has since its establishment been a part of the War Department, using its officers, machinery, and implements, was, by law, formally turned over to the Department of Agriculture, and while it has been useful in the past, it is now in its proper place, and the arts of war become once more the arts of peace. A more general application of results obtained through the Weather Bureau will now be made in the interest of agriculture.

The first step of Secretary Rusk was to find a head to direct and a hand to guide, well trained and adapted to so important a mission. These were found in the person of Prof. Mark W. Harrington, one of the best scientific and practical meteorologists of this or any other country. A native of Illinois, born and brought upon a farm, like the Secretary, he is in full touch with the tillers of the soil.

Following up its former action in helping to bring about the transfer before alluded to, the Grange has heartily co-operated with the Secretary of Agriculture and the Chief of the Weather Bureau in extending the benefits of the Weather Service to the fields of the farm. A few months after the transfer the National